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DE	31 07 620 A1
DE	24 58 934 A1
DE	24 07 990 A1
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(54) Vorrichtung für die katalytische Reinigung von Fahrzeugmotor-Abgasen

Vorrichtung für die katalytische Reinigung von Fahrzeugmotor-Abgasen, mit einem Gehäuse (2), mindestens einem Monolithen (4) und einer mindestens bereichsweise vorgesehenen Innenschale (12). Die Innenschale (12) ist mindestens in einem Teil des Monolith-Aufnahmebereichs (8) des Gehäuses (2) an dieses herangeführt und dort befestigt. Das dem Gehäuseende zugeordnete Ende der Innenschale (12) ist frei für Wärmedehnungsbewegungen relativ zu dem Gehäuse (2) ausgebildet.

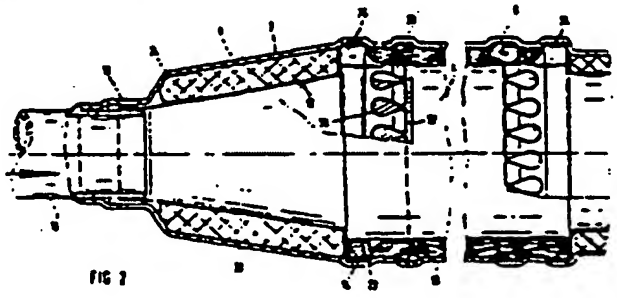

FIG 1

- Heat shield

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Abstract:

A device for the catalytic purification of automobile engine exhaust gases consisting of a housing (2), at least one monolith (4) and one of at least in certain places provided interior shell (12). The interior shell (12) is led up to the housing (2) in at least one part of the monolith mounting area (6) of the housing (2) and is attached thereto. The end of the interior shell (12) situated at the outlet end of the housing, is freely extending for permitting thermal expansion motions relative to the housing (2).

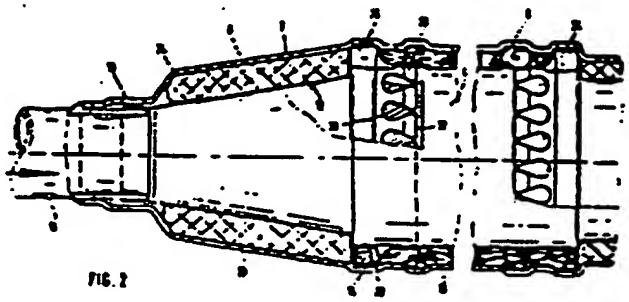

FIG. 2

PATENT CLAIMS

1. A device for the catalytic purification of automobile engine exhaust gases consisting of a housing (2) with a connecting section (10) for the exhaust pipe (18) at both ends and with a transitional section (8) between each of the respective connecting sections (10) and a monolith mounting section (6),
containing at least one monolith (4) coated with a catalytically effective coating layer and positioned in the monolith mounting section (6) in the housing (2),
and containing one at least in certain places of the housing (2) provided interior shell (12) consisting of a temperature resistant sheet metal, mounted in the transitional sections (8) a distance apart from the housing (2),
and containing a spacer mat in the space between the housing (2) and the monolith (4) for permitting the different thermal expansions of the housing (2) and the monolith,
wherein the interior shell (12) is led up to the housing (2) in at least one part of the monolith mounting area (6) of the housing (2) and is attached thereto by means of welding (26) or a pleating connection,
whereby the end of the interior shell (12) reaching the exhaust pipe connecting section is freely extending for permitting thermal expansion motions relative to the housing (2).

2. A device according to claim 1, wherein the interior shell (12) at the side of its fastening to the housing (2) opposite the side facing the transition section (8), is arranged at a distance from

the housing and provided with a fastening area (28) for the monolith (4).

3. A device according to claim 2, wherein the interior shell (12) seen in the lengthwise direction of the housing (2), is formed as a multisectional part, whereby the respective end-fastening area is provided with peripherally distributed elastic tongues (28).

4. A device according to claim 3, wherein the tongues (28) are formed as essentially omega-shaped stamped out latches (30).

5. A device according to one of the claims 1 to 4, wherein an insulating mat (20) is provided in the transition section (8) between the housing (2) and the interior shell (12), preferably consisting of an expandable mat.

6. A device according to one of the claims 1 to 5, wherein the spacer mat (16) and/or the insulating mat (20) are frontsided protected by a ring (22).

7. A device according to one of the claims 1 to 6, wherein the spacer mat (16) and/or the insulating mat (20) are frontsided protected by a jacket.

8. A device according to one of the claims 1 to 7, wherein the interior shell (12) is covering the edge area of the monolith at the transition section side.

9. A device according to one of the claims 1 to 8, wherein the particular connecting-side end of the interior shell (12) is mounted by a sliding fit between the housing (2) and the respective exhaust pipe end.

10. A device according to one of the claims 1 to 9, wherein at least one elastic intermediate layer (32) is provided between the interior shell (12) and the monolith (4).

11. A device according to one of the claims 1 to 10, wherein two monoliths (4) are provided in series one after the other in the housing (2).

12. A device according to claim 11, wherein the interior shell (12) consists of a 3-part shell, whereby the central part of the interior shell is attached to the housing (2) by means of welding or a pleating connection.

13. A device according to claim 12, wherein the central part of the interior shell is fitted with fastening sections at both ends for both monoliths with peripherally distributed elastic tongues, preferably formed as essentially omega-shaped stamped out latches.

DESCRIPTION

The invention deals with a device according to the generic term of claim 1.

Devices of this kind have been known, where the interior shell extends along the outer periphery of the monolith and a spacer mat is placed between the housing and the interior shell. In this arrangement, the not particularly precise and stable mounting of the interior shell by means of the spacer mat, is felt to be a disadvantage.

It has further been known to build a device of the aforementioned kind, where the interior shell is mounted in parallel to the inner wall of the housing in the mounting section of the monolith and the spacer mat is placed between the interior shell and the monolith, whereby the interior shell is attached to the housing in the connecting sections but not in the monolith mounting section. However, in this case, too, an insufficiently stable mounting of the interior shell in the monolith mounting section is experienced.

Finally, a device of the aforementioned kind has been known, where the interior shell is installed in the transitional areas and welded to the housing in the respective pipe connection areas. At the end of the interior shell forming the mounting side for the monolith, the edge of the particular shell will fit into a ring in a relatively movable manner in the length direction, whereby the ring is attached to the housing with its other axial end area. Therefore, the sliding connection between the interior shell part and the ring is located in a zone, which is strongly exposed to the exhaust gases. Besides, the mounting of the monolith exclusively stabilized by the spacer mat between the housing and the monolith, will not provide a sufficiently stable positioning.

The objectives to be achieved by the present invention deal with the development of a device of the aforementioned kind, whereby the monolith will be firmly and securely crosswise fastened in relation to the length direction of the housing and will provide a durable functioning of controlling the different lengthwise thermal expansions of the housing and the interior shell.

The objectives have been achieved according to the invention by a device as specified in the characteristic part of claim 1.

According to the invention, the interior shell is firmly attached to the housing in the mounting section for the monolith and the relative motions between the housing and the interior shell, caused by the different thermal expansions, will be compensated in the exhaust pipe connection area. The last mentioned feature as such has already been known.

If mentioning in claim 1 that the spacer mat is contained in the space between the housing and the monolith, this shall not mean, that the spacer mat will necessarily be in contact with its outer surface at the housing and with its interior surface at the monolith. It may rather mean, but without the inference of an exclusive meaning, that e.g. the interior shell is inserted between the outer surface of the spacer mat and the housing or also between the interior surface of the spacer mat and the monolith, referring in particular to an areal arrangement. The expression that "the interior shell is led up to the housing" shall not necessarily mean a direct adjoining contact of the interior shell with the housing.

It may rather, but not exclusively mean, that an intermediate layer may also be provided at this location.

It is preferred to lead the interior shell up to the housing only for a relatively short axial length and to attach the shell to the

housing at this location and then, to lead the interior shell again away from the housing and to provide at this location a direct or indirect mounting feature with the monolith. This arrangement will improve the structural stability of the mount of the monolith. The attachment of the interior shell to the housing is preferably carried out at the location, at which an end of the monolith is positioned.

Starting from the particular transition sections, the interior shell may extend over the length of the monolith. However, it is preferred to let the interior shell end a short distance behind the particular front edge of the monolith, whereby e.g. in the case of only one monolith mounted in the housing, the two interior shells are installed at opposite ends. As a favorable feature, it is preferred to have peripherally distributed elastic tongues fitted at the monolith-sided end areas of the interior shells for mounting the monolith and for taking into account the different thermal expansions between the monolith and the interior shells and the housing, respectively. The tongues are preferably formed as essentially omega-shaped stamped out sections, by which the radial elasticity of the tongues is favored and yet relatively large contact areas are assured between the tongues and the monolith or between the tongues and the spacer mat placed and pressed around the tongues.

The installation of an interior shell has primarily the purpose to shield the housing from the direct effects of the exhaust gases and to keep it cool. This objective is achieved by providing a space between the interior shell and the housing in the transition areas. This effect can be further increased by placing an insulating mat in the space between the housing and the interior shell in the transition area. This insulating mat may in particular consist of a so-called expandable mat

of a commonly known material, which will expand under the effect of heat. It may also be considered to protect the frontside of the insulting mat by a ring consisting also of an expandable material or an elastically sealing material or by a heat resistant support, whereby the insulating mat may consist of a less demanding material. The primary concern in this case is the protection of the insulating mat from a being washed or blown out and being lost due to the pulsating ejection of the exhaust gases.

It is further preferred to protect the spacer mat as much as possible from the undesirable effects of the exhaust pulsations. The preferred possibilities include in this case an axial offsetting of the frontside (n) of the spacer mat, a providing of a particular elastic sealing ring, a providing of a jacket or a support rim at the frontside or frontsides, respectively, of the spacer mat or also a retracting of the interior shell before the frontside or frontsides, respectively, of the monolith. It is understood, that the mentioned rings, supports and jackets are to consist of a sufficiently temperature resistant material. The spacer mat is preferably formed from an expandable material.

A particularly secured and inherently gas-tight connection of the interior shell to the housing at the connecting area between the device and the exhaust pipe, is achieved by fitting this end of the interior shell into a sliding gap between the housing and the particular end of the exhaust pipe. It is also possible to additionally provide a sealing ring at this connection.

For a further improvement of the stability of the mount of the monolith, at least one elastic intermediate layer may be placed between the interior shell and the monolith, whereby the monolith is more securely held in place due to the increased friction and whereby a direct

contact between the metal of the interior shell and the monolith is avoided.

Preferably, the device contains two or also more monoliths placed in series one behind the other in the length direction of the housing, whereby the required large catalytically effective surface can be achieved at a possibly small diameter of the device.

In this case, it is preferred to have a three-part interior shell, whereby the central part of the interior shell is firmly attached to the housing by means of welding or a pleated connection. In this case, the central part of the interior shell has fastening features at both ends for mounting the two monoliths, as already described above for fastening the one-piece monolith to the interior shell or parts of the interior shell, respectively.

If the interior shell is to be attached to the housing by means of welding, a so-called slot-welding is preferred as being particularly economical from production-engineering point of view.

The criteria specified in the sub-claims have in part also an independent significance without an inclusion of the criteria of the independent claim.

The invention and further developments of the invention shall be further explained in the following by referring to the attached drawings.

Fig. 1 and 2 show each a lengthwise sectional view through a part of a device for a catalytic purification of exhaust gases, whereby each of the two drawings includes several variants.

In the illustrated execution examples. two monoliths (4) are axially mounted in series in the housing (2). The drawings present in each case the left side of the device, which is to be imagined supplemented to the right as a mirror image of the left side.

The housing (2) of the device illustrated in fig. 1 consists of a central mounting section (6) for the monolith of a cylindrical shape with the exception of several peripheral circular foldings. The housing extends to the right and left into an essentially conical transition section (8) and at the end of each transition section (8), into an essentially cylindrical connection area (10). The housing (2) consists of a sheet of steel and is preferably composed of two semicircular halves cut along an axial plane.

As seen in fig. 1, an interior shell (12) extends from the left connection area (10) over the transition section (8) and over a part of the monolith mounting area (6). This interior shell (12) begins at the left, a short distance behind the end of the connection area (10) and has at this location a small radial distance to the housing (2). In the transition area (8), the interior shell (12) is aligned in parallel to the housing (2) with a radial distance from 2 to 15 mm. At the end of the transition area (8), the interior shell (12) is bent outward and laid against the interior wall of the housing (2). The interior shell (12) is form-locking positioned by at least one inwards embossed fold (14) of the housing (2) in the left end area of the mounting section (6).

In the mounting section (6), two monoliths (4) are mounted at a certain axial distance, from which the monolith at the left side is illustrated in fig. 1. The monolith (4) is cylindrically shaped and consists of a ceramic material axially traversed by a multitude of channels, which are vapor-coated with a catalytically effective substance. Between the interior shell (12) and the monolith (4), a spacer mat (16) with a thickness from 2 to 15 mm is placed covering the mounting area (6) and ending at the left side a short distance before the frontside of the monolith (4). The spacing of the interior shell (12)

from the housing (2) in the transition to the mounting area (6) is chosen in such a way, that the interior shell (12) will slightly cover the frontside of the monolith (4) at its outer edge. Thereby, the monolith (4) will be axially supported and a certain sealing is achieved against gases flowing around the monolith (4).

In the connection area (10), the end of an exhaust pipe (18) is inserted from the left side, reaching with small tolerances into the end of the interior shell (12). The exhaust pipe (18) is from the outside welded to the connection part (10). Thereby, the left end of the interior shell (12) will reach into a ring-shaped gap between the end of the exhaust pipe (18) and the connection part (10) of the housing, providing a possibility for an axial expansion and contraction of the interior shell (12) as well as also a certain labyrinth-like sealing against a propagation of the exhaust pulsations into the space between the housing (2) and the interior shell (12).

In the transition area (8), a jacketing insulating mat (20) is placed between the housing (2) and the interior shell (12). This mat (20) may be additionally protected at the left side, or at the left and right side, by a ring (22) consisting of a heat-expandable material (fig. 1, lower side) or by a frontsided support (24) of a heat-resistant woven material (fig. 2, upper side). The same additional supports may also be provided for the spacer mat (16), as seen in fig. 1 and 2 (lower part). The ring (22) preferably consists in this case of a pressed heat-resistant wire-mesh or -cloth as the case may be, interspersed or jacketed with heat-resistant ceramic fibers. The rings (22) may be formed as gasket rings serving in particular as an additional seal against gases flowing around the monolith (4).

In the left part of the mounting area (6) shown in fig. 1, the

possibility is indicated, that the interior shell (12) may extend over the entire length of the mounting area (6). This is actually not critical in regard to the thermal expansion, since the heat-insulating spacer mat (16) is positioned in-between and the heat transfer from the transition area (8) along the thin interior shell (12), is minor.

On the other hand, at the right side of fig. 1, the possibility is illustrated to terminate the interior shell (12) a short distance behind the frontside of the monolith (4).

The execution example illustrated in fig. 2 corresponds to the already described examples with the exception of the following modifications:

In the upper part of fig. 2, the fastening of the interior shell (12) to the housing (2) by means of a slot-welding (26) at the beginning of the mounting area (6) at the outer circumference is indicated.

Furthermore, the first part of the interior shell (12) ends a short distance behind the left frontside of the monolith (4). In this end zone of the first interior shell part, the shell is shaped in axially directed tongues (28) distributed over the entire circumference, whereby the tongues are formed by stamping out omega-shaped sections (30). These tongues (28) will fit against the outside of the monolith (4), as the case may be, by inserting an elastic intermediate layer (32) to provide a large areal but elastic mounting of the monolith (4). Next to the described attachment to the housing (2) by means of slot-welds (26), the interior shell (12) is bent inwards away from the housing (2), whereby the tongues (28) will directly or indirectly lay against the monolith (4). Thereby a certain sealing effect is again achieved. The spacer mat (16) extends from the center of the monolith (4) to this transition area of the diameter.

In the central area of the mounting section (6), the central part (34) of the 3-part interior shell (12), is placed. This central part (34) is fitted at both sides with tongues of the described kind (28) and fastened in the end area of the monolith (4) by means of a pleated connection. Instead of the slot-welds (24) shown at the left side of fig. 2, a pure pleated connection may also be used.

The insulating mat (20) as well as also the spacer mat (16) preferably consist of ceramic fibers interspersed with expandable mica.

The sheet-metal of the interior shell (12) is to have a higher temperature resistance and is to be thinner than the sheet-metal of the housing (2). The interior shell (12) or its parts, respectively, may be prepared from shell-halves as described for the housing (2).

Translated by Hans L. Schlichting --- 251-2B-11

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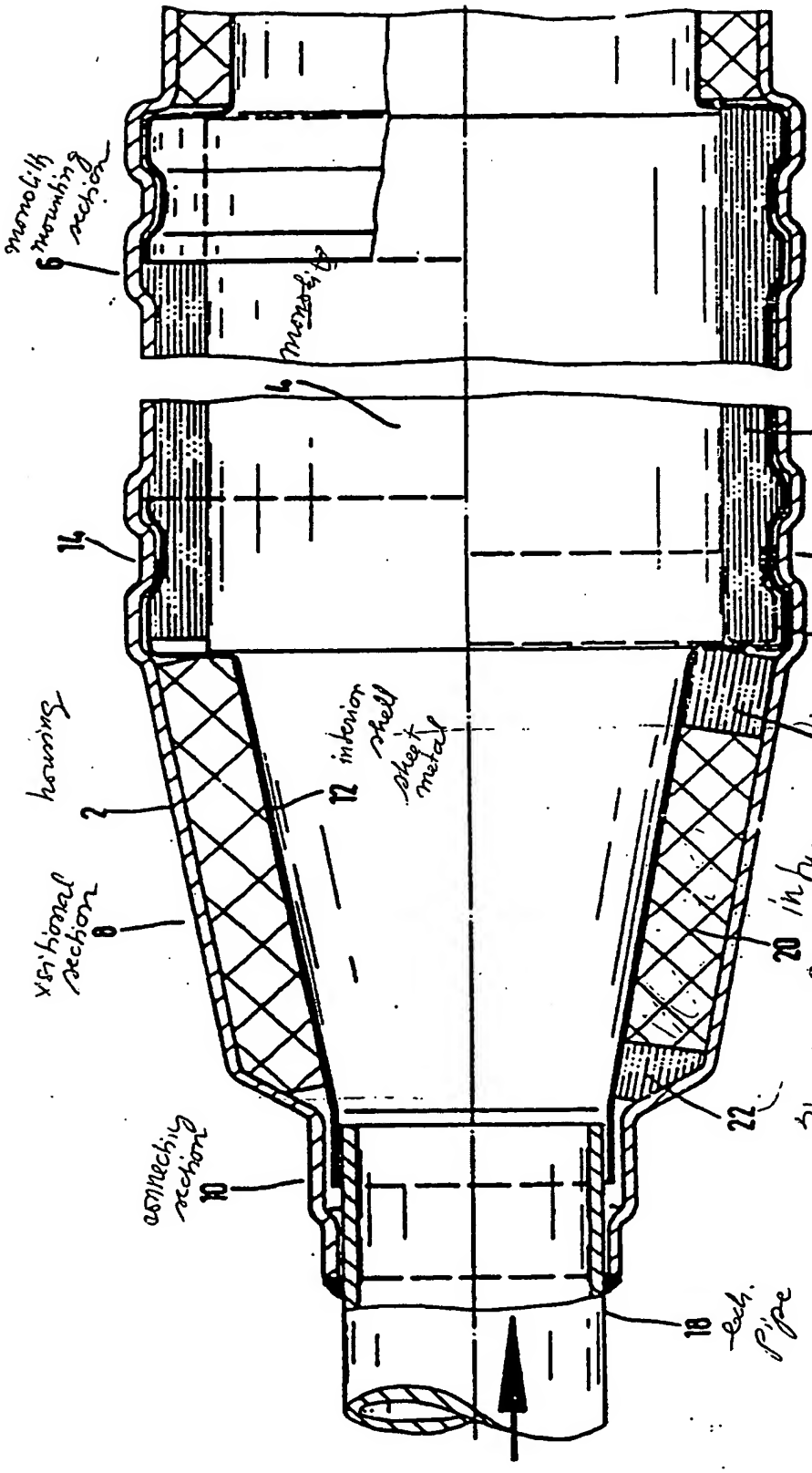
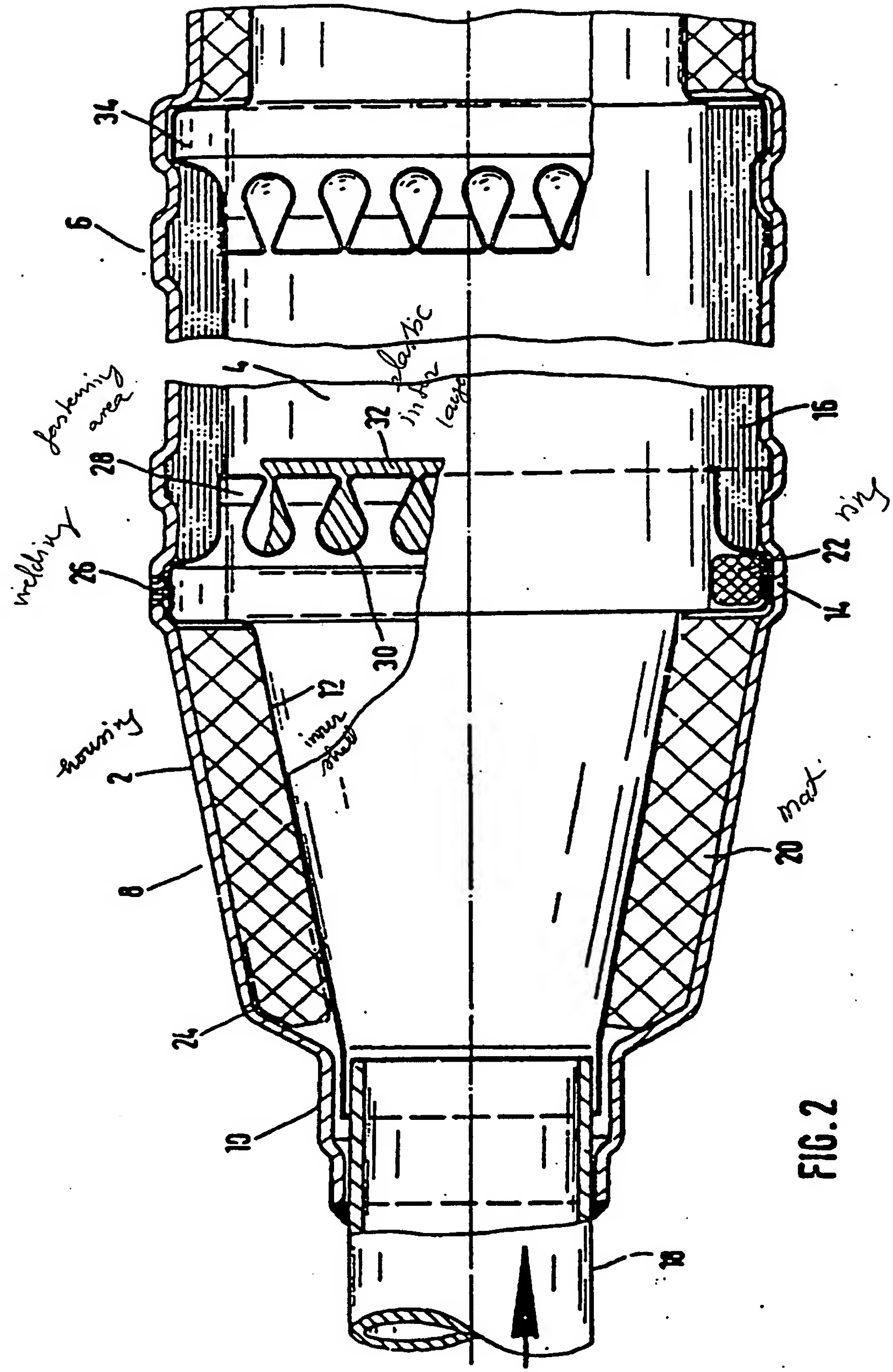


FIG.1


34
6
4
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fastening area
32
28
16
welding
26
22 ring
14
30
12
inner shell
housing
2
8
20 mat
24
10
18

FIG. 2